

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

In re Patent Application of

Atty Dkt. 899-26

C# M#

DODD et al

TC/A.U.: 1772

Serial No. 09/890,860

Examiner: Aughenbaugh, Walter

Filed: October 16, 2001

Date: May 30, 2006

Title: HEAT TRANSFER ELEMENT

Mail Stop Appeal Brief - Patents

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450



Sir:

☐ **Correspondence Address Indication Form Attached.**

☐ **NOTICE OF APPEAL**

Applicant hereby **appeals** to the Board of Patent Appeals and Interferences
from the last decision of the Examiner twice/finally rejecting
applicant's claim(s).

\$500.00 (1401)/\$250.00 (2401) \$

☒ An appeal **BRIEF** is attached in the pending appeal of the
above-identified application

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-\$ ()

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The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or
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firm) to our **Account No. 14-1140**. A duplicate copy of this sheet is attached.

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NIXON & VANDERHYE P.C.

By Atty: Bryan H. Davidson, Reg. No. 30,251

Signature: _____



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For: **HEAT TRANSFER ELEMENT**

* * * * *

Tuesday, May 30, 2006
(Monday = Memorial Day Holiday)

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APPLICANTS' APPEAL BRIEF

This Appeal is from the Examiner's Official Action dated December 27, 2005, twice/finally rejecting claims 53-61 and 64-67, all of the claims presently pending herein.¹ As will become evident from the following discussion, the Examiner's rejections are in error and, as such, reversal of the same is solicited.

05/31/2006 JADD01 00000101 09890860
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¹ The claims on appeal appear in the Claims Appendix accompanying this Brief.

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I. Real Party In Interest

The real party in interest the assignee of the subject application, namely Security Composites Limited.

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II. Related Appeals and Interferences

The appellant, the undersigned, and the assignee are not aware of any related appeals, interferences, or judicial proceedings (past or present), which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

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III. Status of Claims

- A. The following claims are presently pending in this application and have been rejected in the Examiner's Official Action of December 27, 2005: Claims 53-61 and 64-67.
- B. The following claims have been cancelled during prosecution to date: Claims 1-52 and 62-63.
- C. The following claims have been allowed: None

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IV. Status of Amendments

No Amendments subsequent to the Official Action dated December 27, 2005 have been filed.

V. Summary of the Claimed Subject Matter

According to one aspect of the invention as defined by independent claim 53, an elongate tubular heat transfer element is provided having a longitudinal tube axis and comprising a wall of monolithic construction having an outer surface and an inner surface. The inner surface determines a boundary of a hollow interior which extends longitudinally of the tube axis of the heat transfer element. (Page 3, lines 7-15 and page 8, line 15 through page 9, line 16) The wall is formed from a composite material (which is in contact with the hollow interior) comprising a matrix and rovings embedded in the matrix. The matrix of the composite material consists essentially of a fluoropolymer selected from polyvinylidene fluoride and copolymers of at least 80% by weight, based upon the weight of the copolymer, of vinylidene fluoride and up to 20% by weight, based upon the weight of the copolymer, of at least one other fluorine based monomer selected from tetrafluoroethylene, hexafluoropropylene and vinyl fluoride. (Page 9, line 21 through page 11, line 12) The rovings embedded in the matrix comprise boron-free chemically resistant glass fibres and are present from about 20% to about 60% by volume based upon the volume of the composite material. (page 6, line 24 through page 7, line 29) Such rovings are provided by rovings which extend longitudinally in a lengthwise direction parallel to the tube axis of the tubular heat transfer element and rovings which extend spirally around the tube axis. (Page 8, lines 15-27)

According to another aspect of the invention as defined by independent claim 58, an elongate tubular heat transfer element is provided having a longitudinal tube axis and comprising a wall of monolithic construction having an outer surface and an inner surface. The inner surface determines a boundary of a hollow interior which extends longitudinally of the tube axis of the heat transfer element. (Page 3, lines 7-15 and page 8, line 15 through page 9, line 16) The wall of the heat transfer element is formed from a

composite material (which is in contact with the hollow interior) comprising a matrix and rovings embedded in the matrix. The matrix consists essentially of polyvinylidene fluoride having embedded therein rovings of boron-free chemically resistant glass fibres, the rovings comprising from about 20% to about 60% by volume based upon the volume of the composite material and including rovings which extend longitudinally in a lengthwise direction parallel to the tube axis of the heat transfer element and rovings which extend spirally around the tube axis. (Page 9, line 21 through page 11, line 12 and Page 8, lines 15-27)

VI. Grounds of Rejection to be Reviewed on Appeal

1. Claims 53-61 have been rejected under 35 USC §103(a) as allegedly unpatentable over Swozil et al (USP 5,211,220) in view of Baurmeister (USP 4,940,617).
2. Claims 64-67 have been rejected under 35 USC §103(a) as allegedly unpatentable over Swozil et al in view of Baurmeister and in further view of O'Connor (USP 4,800,113)

VII. Arguments

A. General Comments

The Applicants' invention is concerned with heat transfer elements, more particularly with heat transfer elements of the type used as radiant panels in the construction of heat exchangers for use in electric power generating stations. As taught by page 1 lines 9 to 26 of the Applicants' specification, there may be around 30,00 square meters (i.e. around 229,913 square feet) of such radiant panels in a single heat exchanger and there may be twelve or more heat exchangers in a single electric power generating station. It will accordingly be readily apparent that even a slight reduction in the cost of such radiant panels will have a major impact on the overall cost of construction of an electric power generating station.

In one embodiment the Applicants have invented a novel heat transfer element which is in the form of a thin panel, which is typically from about 0.4 mm to about 1.2 mm thick (i.e. about 0.016 inches to about 0.047 inches thick). Such a panel has not only to be self-sustaining, but must also be resistant to harsh physical conditions, including exposure to hot air and steam moving at high speed at temperatures of up to about 150°C. It also has to be resistant to corrosive chemicals, such as sulphurous and nitrous acids which may be present in the air stream. Another requirement is for it to be resistant to clogging with soot or debris, which might otherwise clog the radiant panels. Moreover it must also stand up to rapid thermal cycling. It must also conduct heat rapidly from one of its faces to the other. These requirements are, as the Examiner will appreciate, extremely demanding. The need for such properties is taught by the aforementioned passage at page 1 lines 9 to 26, as well as by the paragraph from page 2 line 26 to page 3 line 1, of the Applicants' specification.

Prior art heat transfer elements have traditionally consisted of coated metal panels. However, these rely upon the integrity of the coating for successful operation.

There has also been proposed in United States Patent No. 4,461,347 (Santo et al.), as mentioned in the Applicants' specification, a heat exchanger assembly comprising coaxially arranged inner and outer pipes. The inner pipe can be formed of high strength metal and ensheathed by an extruded heat shrinkable plastics tube of non-reactive material, such as polytetrafluoroethylene or polypropylene. Another prior art proposal is for a plate heat exchanger comprising at least three plate elements consisting of graphite and a fluoropolymer, such as polyvinylidene fluoride is disclosed in European Patent Specification No. 0 203 213 A1 (Künzel). It is also proposed in British Patent Specification No. 2 255 148A (Moore et al.) to construct a structurally composite metal and plastics tube in which the metal forms a tubular core having openings throughout its length occupying at least 5% of its total surface area while the plastics material forms imperforate inner and outer layers, each at least 0.1 mm thick, covering the inside and outside of the metal core and integrally joined through the openings.

The Applicants' inventive heat transfer panel is made (as described, for example, in the Applicants' Example 5) by laminating under appropriate temperature and pressure conditions a pad of glass fibres between two films made of a thermoplastic polymer, more particularly films of polyvinylidene fluoride or of a copolymer containing at least 80% vinylidene fluoride and no more than 20% of another fluorinated monomer selected from tetrafluoroethylene, hexafluoropropylene and vinyl fluoride. Although glass fibres are not normally noted for good thermal conductivity properties, by utilizing glass fibres in an amount corresponding to from about 20% to about 60% by volume of the heat transfer element the Applicants have found that the resulting heat transfer element possesses good thermal transfer properties. It is important that the glass fibres should be chemically resistant and, for this reason, boron-free glass fibres are particularly preferred.

A. Patentability of Claims 53-61 over Swozil et al in view of Baurmeister

The Examiner has repeatedly asserted that the pending claims 53-61 are "obvious", and hence unpatentable over Swozil view of Baurmeister. Applicants emphatically disagree.

In this connection, the Examiner has characterized Swozil as comprising a wall being the fibre layer which is comprised of fibres with the fluorine-containing polymer. With respect to the Examiner, the structure he describes in Swozil is most certainly not a wall as defined in the present invention. Instead, it is merely a coating/wrapping on a *pre-existing* tube. Thus, the fibre containing layer is not the wall of the heat exchanger.

The Examiner apparently acknowledges that Swozil fails to "explicitly teach" that the inner surface of the wall determines the boundary of a hollow interior which extends longitudinally at the axis of the tube. In fact, applicants note that Swozil does more than fail to explicitly teach such structure, it positively teaches the *opposite* of the inner surface of the wall if, as the Examiner asserts, the "wall" is the fibre layer comprising fibres coated with a fluorine-containing polymer. Specifically, Swozil merely shows a wrapping/coating on a pre-existing tube that defines the inner surface of the wall determining a boundary of the hollow interior.

Similarly the Examiner has suggested that Swozil fails to explicitly teach that the composite material is in contact with the hollow interior. Again, not only does it fail to explicitly teach, it positively teaches that the composite material is *not* in contact with the hollow interior.

In addition to the two structural features detailed above, the Examiner has also acknowledged that Swozil fails to teach the presence of the rovings as comprising from about 20% to about 60% by volume of the composite material.

To overcome these several deficiencies in Swozil, the Examiner then apparently turns to Baurmeister. Again with all due respect, Baurmeister has no relevance to the present invention and could not or would not be combined with Swozil. In this regard, Baurmeister relates to a multi-layer hollow fibre wound body. Hollow fibres are not even remotely similar to the fibres used in the present invention or in Swozil. Instead, hollow fibres are in a technology field of their own which is most certainly disparate from the fibre rovings of the present invention. Any teaching relating to hollow fibres in Baurmeister therefore has no relevance to an invention relating to glass fibre rovings.

Applicants further note that, just because a document relating to the field of hollow fibres suggests that a multi-layer wound body can be used in an arrangement in which fibres cross, does not mean that there is any teaching that a **tubular heat exchanger** can be formed from a wall comprising a matrix having rovings embedded therein in the manner defined in the claims 53-61 of the present application. It is noted that in column 5 of Baurmeister, it is stated that the hollow fibre wound body of Baurmeister is suitable for the production of numerous structures, including filters, oxygenators, hemofilters, blood adsorbers and separators, iv filters, cross-flow microfilters, gas separators, membrane distillation devices, bioreactors, adsorbers, absorbers, desorption agents, dialysers, exchange columns, packing for packed columns, controlled slow release of active substances, odorous substances and the like. It should be noted that the "exchange columns" referred to by Baurmeister cannot be equated with heat exchangers as heat exchangers do not use hollow fibres. Such a technical reality is self-evident since, if a hollow fibre was used in a heat exchanger, more than heat would be exchanged.

As discussed in columns 5 and 6 of Baurmeister, the hollow fibre matting disclosed therein is used in an arrangement in which fluid flows around the hollow fibres and **material is exchanged** through the wall of the hollow fibre into its hollow centre.

This would not at all be suggestive to an ordinarily skilled person to employ the therein disclosed fibre arrangement in any form of a heat exchanger.

Notwithstanding such technical incompatibilities of Baurmeister, the Examiner has suggested that Baurmeister nonetheless discloses a heat exchanger and has referred the applicants' attention to column 9, lines 7-14. While the section identified in column 9 does mention heat exchange generally, it is also discussing the exchange of matter. This is very different to the arrangement of the present invention. The Examiner has also identified column 14, lines 15-19 as a basis in Baurmeister for disclosing a heat exchange tube. With respect, this passage simply refers to the winding of the hollow fibre mat being on a core. There is no suggestion that this is a heat exchanger. Further, by the very fact that it requires a core, it takes it outside the present invention. Similar comments can be made to the other passages identified by the Examiner. The Examiner believes that Baurmeister also discloses that the arrangement of fibres assures improved convective heat transport and increased heat transfer. In this connection the Examiner has not taken this passage in context. The reference to heat transfer is not the same as heat exchange of the kind referred to in the present application.

In view of the above, and the comments and arguments advanced during prosecution to date, applicants suggest that the rejection of claims 53-61 is in error and must be reversed.

B. Patentability of Claims 64-67 over Swozil et al in view of Baurmeister and in further view of O'Connor

The comments above are equally germane to the erroneous rejection of claims 64-67 based on the combination of Swozil et al, Baurmeister and further in view of O'Connor. In this regard, it appears that O'Connor is being combined with Swozil et al and Baurmeister for its teaching of employing metal particulates in combination with

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plastics material. Applicants again reiterate that they are not claiming to be the first inventors of incorporating metal particulates in combination with plastics material generally. Thus, even if O'Connor were to be combined with Swozil and Baurmeister, the present invention would not result for the reasons stated above and previously on the record. Thus, reversal of the rejection of claims 64-67 is in order also.

Favorable action consistent with the proper reviewing standards under 35 USC §103(a) requires reversal of all rejections of record. Such action is therefore solicited.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

53. An elongate tubular heat transfer element having a longitudinal tube axis and comprising a wall of monolithic construction having an outer surface and an inner surface which determines a boundary of a hollow interior which extends longitudinally of the tube axis of the heat transfer element, said wall being formed from a composite material comprising a matrix and rovings embedded in the matrix, wherein the composite material is in contact with the hollow interior, and wherein the matrix consists essentially of a fluoropolymer selected from polyvinylidene fluoride and copolymers of at least 80% by weight, based upon the weight of the copolymer, of vinylidene fluoride and up to 20% by weight, based upon the weight of the copolymer, of at least one other fluorine based monomer selected from tetrafluoroethylene, hexafluoropropylene and vinyl fluoride, and wherein the rovings embedded in the matrix comprise boron-free chemically resistant glass fibres, the rovings comprising from about 20% to about 60% by volume based upon the volume of the composite material and including rovings which extend longitudinally in a lengthwise direction parallel to the tube axis of the tubular heat transfer element and rovings which extend spirally around the tube axis.

54. An elongate tubular heat transfer element according to claim 53, wherein the fluoropolymer is polyvinylidene fluoride.

55. An elongate tubular heat transfer element according to claim 53, further comprising a first layer adjacent the outer surface of the wall, a second layer surrounding the first layer, and at least one other layer intermediate the first and second layers, wherein the first, second and at least one other layers each include rovings, and wherein the rovings of a particular layer all extend substantially in a common direction which is different from the common direction of any adjacent layer, and wherein the common direction is in each case selected from a direction extending spirally around

the tube axis and a direction extending longitudinally in a lengthwise direction parallel to the tube axis.

56. An elongate tubular heat transfer element according to claim 53, wherein the wall comprises a first layer adjacent the inner surface, a second layer adjacent the outer surface, and an intermediate layer between said first and second layers, and wherein the rovings in the first layer of the wall adjacent the inner surface and the rovings in the second layer of the wall adjacent the outer surface each extend spirally around the tube axis and wherein the rovings in the intermediate layer of the wall between the first and second layers extend longitudinally in a lengthwise direction relative to the tube axis of the tubular heat transfer element.

57. An elongate tubular heat transfer element according to claim 56, wherein the rovings in the intermediate layer comprise about 60% of the total rovings and wherein the rovings of the first and second layers together comprise about 40% of the total of all rovings in the heat transfer element.

58. An elongate tubular heat transfer element having a longitudinal tube axis and comprising a wall of monolithic construction having an outer surface and an inner surface which determines a boundary of a hollow interior which extends longitudinally of the tube axis of the heat transfer element, said wall being formed from a composite material comprising a matrix and rovings embedded in the matrix, wherein the composite material is in contact with the hollow interior, and wherein the matrix consists essentially of polyvinylidene fluoride having embedded therein rovings of boron-free chemically resistant glass fibres, the rovings comprising from about 20% to about 60% by volume based upon the volume of the composite material and including rovings which extend longitudinally in a lengthwise direction parallel to the tube axis of the heat transfer element and rovings which extend spirally around the tube axis.

59. An elongate tubular heat transfer element according to claim 58, further comprising a first layer adjacent the outer surface of the wall, a second layer surrounding the first layer, and at least one other layer intermediate the first and second layers, wherein the first, second and at least one other layers each include rovings, and wherein the rovings of a particular layer all extend substantially in a common direction which is different from the common direction of any adjacent layer, and wherein the common direction is in each case selected from a direction extending spirally around the tube axis and a direction extending longitudinally in a lengthwise direction parallel to the tube axis.

60. An elongate tubular heat transfer element according to claim 58, wherein the wall comprises a first layer adjacent the inner surface, a second layer adjacent the outer surface, and an intermediate layer between said first and second layers, and wherein the rovings in the first layer of the wall adjacent the inner surface and the rovings in the second layer of the wall adjacent the outer surface each extend spirally around the tube axis and wherein the rovings in the intermediate layer of the wall between the first and second layers extend longitudinally in a lengthwise direction relative to the tube axis of the tubular heat transfer element.

61. An elongate tubular heat transfer element according to claim 60, wherein the rovings in the intermediate layer comprise about 60% of the total rovings and wherein the rovings of the first and second layers together comprise about 40% of the total of all rovings in the heat transfer element.

64. An elongate tubular heat transfer element according to Claim 53, wherein the composite material further comprises a particulate metal.

65. An elongate tubular heat transfer element according to Claim 58, wherein the composite material further comprises a particulate metal.

66. An elongate tubular heat transfer element according to Claim 53, wherein the composite material further comprises a particulate thermally conductive material.

67. An elongate tubular heat transfer element according to Claim 58, wherein the composite material further comprises a particulate thermally conductive material.

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IX. EVIDENCE APPENDIX

(Not Applicable)

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X. RELATED PROCEEDINGS APPENDIX

(Not Applicable)

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XI. Certificate of Service

(Not Applicable)